# Crane, Hoist, Rigging & Forklift Safety Program
# At The
# Lawrence Berkeley National Laboratory

## Program Assessment

## October 13, 2005

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## EXECUTIVE SUMMARY

An assessment of the LBNL Crane, Hoist, Rigging and Forklift Program was conducted in August and September 2005.

The assessment demonstrated that the LBNL Program is in general technically sound, and that the LBNL program for High Value / High Consequence Lifts is an outstanding critical lift program, and that it is well executed in the field.

The assessment revealed three areas of non-compliance with the requirements of PUB-3000 and/or OSHA. These areas are:

- Frequent lack of documented daily inspections for cranes and hoists.
- Frequent lack of documented daily inspections for forklifts.
- Use of cranes, hoists and forklifts by personnel without current operator permits or training.

Immediate action was taken to reinforce the existing requirements throughout the Lab. Additional follow-up is needed to insure ongoing compliance with these requirements.

In addition, the assessment demonstrated that the program materials, while still technically correct, are dated and in need of updating and refreshing. This includes the language in PUB-3000 and EH&S training course materials. Some additional areas for improvement are identified in this report; these include a review of medical qualification requirements for crane and forklift operators and inspection of non-LBNL cranes by the LBNL Rigging Supervisor.

## 1.0 PURPOSE & BACKGROUND

In August 2005, the Berkeley National Lab was advised that DOE Safety staff from Oak Ridge would be at the Laboratory on September 15 to review the Laboratory's response to the July 19, 2004 memorandum by Milton Johnson concerning "Lessons Learned: Hoisting and Rigging Incidents in the Office of Science." The Laboratory's Crane, Hoisting, Rigging and Forklift Program had not been reviewed in its entirety for some time, but was scheduled to be reviewed later this year. Since it was thought that such an internal review would be helpful to the DOE reviewers, EH&S management decided to accelerate the schedule for this review. To facilitate an efficient review of the concerns raised in the Milt Johnson Letter, EH&S Division Management directed that all aspects of the response to that letter be addressed immediately, and that the remainder of the assessment be conducted as expeditiously as possible. A draft of this report, emphasizing the Milt Johnson letter, was completed by September 15 and was reviewed with DOE. This report completes the assessment and addresses the complete hoisting and rigging program.

## 2.0 SCOPE

This review addresses primarily compliance aspects of the crane, hoist, rigging and forklift program. Specifically, the following areas were to be addressed:

- Review of contractual requirements pertaining to Cranes, Hoists, Rigging and Fork Trucks
- Review of how the contractual requirements are implemented in PUB-3000 and other Laboratory documents
- Review of how DOE Lessons Learned on Cranes, Hoists, Rigging and Forklifts are applied at the Laboratory.
- Review of the status of the equipment as it pertains to safety, inspections and maintenance
- Review of the training and authorizations for operators

The methodology was to review the documentation available, to review previous assessments, and to conduct spot checks of how well the program works in the field. Select documents reviewed and/or created as part of this process are referred to as exhibits in this report. They are not attached, but they are available for inspection in the Occupational Safety Group office.

The Berkeley Lab hoisting and rigging program is extensive. There are 65 cranes and hoists with capacities greater than 2 tons and 223 cranes and hoists with capacities up to 2 tons distributed in 28 buildings. There are also 3 truck mounted cranes. Virtually all of the divisions have some cranes or hoists.

There are also 15 electric sit-on forklifts, 18 LP powered forklifts, 3 rough terrain forklifts, and 4 powered walk-behind pallet movers and stackers used by 6 divisions.

## 3.0 ASSESSMENT TEAM

The team consisted of the following individuals, whose principal areas of contribution are indicated:

Richard DeBusk, Occupational Safety Manager
General direction

Matt Kotowski, Hoisting & Rigging Safety Program Manager
Occupational Safety Group
Report writing, training program review, coordination

Jean Myers, Safety Support Contractor
Field assessments, documentation review

Aaron Zude, Safety Support Contractor
Standards review, policy review, documentation review

The results of the assessment were reviewed on an ongoing basis by the LBNL Hoisting & Rigging Task Force. This task force consists of the following:

Steve Black, Plant Services Department, Facilities Division
Richard DeBusk, EH&S Division, Occupational Safety Manager
Matt Kotowski, EH&S Division, Hoisting & Rigging Safety Program Manager
Jean Myers, EH&S Division Safety Support Contractor
Dennis Nielsen, Facilities Division, Technical Services Manager
Derek Shuman, Engineering Division, Designee for Lifting Fixtures and High Value/High Consequence Lifts
Kevin Trigales, Facilities Division, Rigging Supervisor
Steve Wright, Facilities Division, Crane and Elevator Office
Aaron Zude, EH&S Division Safety Support Contractor

## 4.0 FINDINGS, OBSERVATIONS & RECOMMENDATIONS

### 4.1 Contractual Requirements

Contractual Standards under LBNL Contract No. DE-AC02-05CH11231 are enumerated in Appendix I of that contract. (Exh. 2) Specifically the following pertain to Cranes, Hoists, Rigging, and Forklifts:

Sufficient Standard 12:
29 CFR 1910, Occupational Safety & Health Standards (as effective on 7/1/2004)
- pertains to cranes, hoists, rigging and fork trucks in general

Sufficient Standard 13:
29 CFR 1926, OSHA Safety & Health Regulations for Construction (as effective on 7/1/2004)
- pertains to cranes, hoists, rigging and fork trucks on construction sites

Sufficient Standard 26:
CCR Title 8, Div. 1, Chapter 4, Subchapter 4, Construction Safety Orders (solely for construction safety where more strict than 29 CFR 1926)
- pertains to cranes, hoists, rigging and fork trucks on construction sites

Sufficient Standard 27:
CCR Title 8, Division 1, Chapter 4, Subchapter 7, General Industry Safety Orders, Group 3, General Plant Equipment and Special Operations, Article 12, Tree Work, Maintenance or Removal, §3427. Safe Work Procedures
- pertains to the use of cranes for lifting personnel into trees for maintenance of removal of trees

Sufficient Standard 76:
ANSI Z133.1-2000, American National Standard for Arboricultural Operations – Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements, Sections 6.7.6 – 6.7.6.11
- pertains to the use of cranes for lifting personnel into trees for maintenance of removal of trees

Sufficient Standard 94:
LBNL Health and Safety Manual (All Sections), PUB 3000
- Chapter 5.4 pertains to mechanical material handling and includes all LBNL crane, hoisting, rigging and forklift requirements.

**Summary:**

The standards include all crane, hoisting, rigging and forklift requirements that are generally mandated for employers in the US. Since the contract also specifies PUB-3000 as a contractually binding document, the contractually required standards and work practices exceed generally mandated requirements to the extent that PUB-3000 specifies practices that exceed OSHA requirements, which is substantial.

## 4.2 PUB-3000 Requirements & Other LBNL Documentation

a. Implementation of OSHA and ASME requirements for cranes, hoists and rigging in PUB-3000

To determine whether PUB-3000 implements the requirements of the OSHA and ASME Standards a paragraph by paragraph comparison of the requirements in OSHA and

ASME with the requirements in PUB-3000 was conducted by Aaron Zude, CSP, a contractor for the EH&S Division. (Exh. 3)

**Summary:**

In general, Chapter 5.4 in PUB-3000 (Exh. 4) incorporates the requirements of OSHA and the ASME standards for cranes, hoists and rigging, as well as for forklifts. The language in PUB-3000 points to other Laboratory publications and to requirements that are contained in other places. These include procurement documents, the crane inspection and maintenance contracts (currently with Crane America Services), and the Facilities Division Crane and Elevator Office. To evaluate whether the program is in compliance we evaluated this additional documentation. See following paragraphs.

b. Additional Documentation for Cranes, Hoists & Rigging

The documentation available in the Facilities Division Crane and Elevator Office was reviewed by Jean Myers. Documents reviewed included crane load tests and maintenance files, including periodic inspection checklists. Samples of work orders, service reports, checklists and load test documentation were collected, as well as sample equipment tags. (Exh. 5) Also examined were documents related to acquisition of cranes and hoists, and one sample record was copied for the assessment files. (Exh. 6) Note also that the Laboratory's Restricted Items List makes two separate references to hoisting and rigging equipment: "Rigging Equipment (e.g. slings, lifting equipment, etc.)", and "Slings". These items may not be purchased without specific Facilities Division approval, and that approval is granted by the Facilities Crane and Elevator Office.

**Summary:**

There are complete and current records for all cranes and hoists in the Crane and Elevator Office. The cranes and hoists are maintained to Cal-OSHA Standards (which meet or exceed Fed-OSHA standards) as a matter of convenience for the crane service contractor. This is an acceptable practice. Checklists used for crane and hoist maintenance list the items that are required to be inspected by OSHA and ASME standards.

**Summary:**

Procurement methodology for cranes and hoists is to invite bids from crane manufacturers with a requirement that crane manufacturers specify what standards they meet. The Berkeley Lab Crane and Elevator Office then reviews the bids to verify that all applicable OSHA and ASME standards are included in the list of standards met by the proposed crane procurement. The Crane and Elevator Office also reviews and approves procurement of all slings and rigging equipment.

c. Additional Documentation for Forklifts

LBNL forklifts are inspected, maintained and repaired by Hyster Sales Company. The equipment is routinely inspected and serviced every 4 month. Sample service reports and invoices were collected for the assessment files. (Exh. 7)

## 4.3 How DOE Lessons Learned on Cranes, Hoists & Forklifts are applied at LBNL

The DOE Lessons Learned distributed in 2004 via the Milt Johnson Letter were transmitted to LBNL in September 2004, and were responded to formally by letter in October 2004. (Exh. 8) LBNL's position at that time was that LBNL did not have corresponding operations at LBNL. No back-up documentation to support the response was available.

To verify that the response was appropriate, Aaron Zude performed an exhaustive analysis of the Lessons Learned. A matrix was constructed that listed the 40 individual Judgments of Need from the 12 incidents that were embodied in the Milt Johnson memo. (Exh. 9) In addition, a Lessons Learned summary for LBNL was constructed and distributed to all instructors of crane, hoist and forklift classes for incorporation in future classes, and this summary was also sent to all currently listed crane, hoist and forklift operators. (Exh. 10)

**Observation 4.3-O1:**

While LBNL's 2004 response to the Milt Johnson Letter was factually accurate, the lessons learned contained useful information that was communicated to appropriate staff only in September 2005.

## 4.4 Status of Equipment As It Pertains To Safety, Inspections and Maintenance

a. Cranes, Hoists & Rigging

LBNL has a contract with Crane America Services for the required periodic inspection of cranes and hoists, as well as for maintenance, lubrication and repair. As a matter of convenience, the contract specifies performance in compliance with Cal-OSHA standards. Since Cal-OSHA standards meet or exceed Fed-OSHA standards as a matter of law, this assures OSHA compliance. In addition, the contractor's inspector also inspects and tags slings and lifting fixtures on a schedule basis.

In the December 2004 – March 2005 time frame, LBNL conducted a detailed review of cranes and below-hook lifting equipment for many of the cranes at LBNL. (Exh. 11) That review was occasioned by the need to identify specific corrective actions for deficiencies identified by the OSHA Inspection of 2004, as well as a desire to verify that

secondary lifting gear was in good condition after it had come to our attention that this had been an issue at SLAC the previous year.

That survey indicated that the cranes and the secondary lifting equipment were in generally excellent condition. A few slings were found that were marginally out of date on the inspection, and a few more were found that had bypassed the inventory process and were not on the inspection list. Those problems were corrected at that time. In addition, a few dozens old shackles were removed from service at that time. (The shackles dated from the time when shackles were rated according to the diameter of the pin, before the requirement for engraving or embossing the load rating on the shackle came into existence.)

As part of this assessment, Jean Myers was commissioned to conduct a field survey of forklifts and cranes and hoists to verify compliance with the requirements of PUB-3000. (Exh. 12) Her survey also included a review of the maintenance records contained in the Crane & Elevator Office. With respect to the status of the equipment, she found that cranes, hoists and secondary lifting equipment were in good condition, with periodic inspections and corresponding inspection records in good order. Deficiencies identified during the earlier survey were either corrected or were part of the OSHA deficiency correction process. However, daily inspections of cranes and hoists were not consistently documented. As a result, a message was sent to all crane and hoist operators, as well as all Division EH&S Coordinators, reminding them of various issues, including the requirement to document daily inspections for hoists and cranes. (Exh. 13)

**Summary:**

Cranes, hoists and secondary lifting equipment were found to be in good condition, with periodic inspections and corresponding inspection records in good order. Deficiencies identified during the earlier survey were either corrected or were part of the OSHA deficiency correction process.

**Finding 4.4.a-F1:**

In many cases the daily inspections of cranes and hoists are not documented on inspection tags attached to the cranes and hoists, as required by PUB-3000.

**Recommendation 4.4.a-R1:**

While immediate corrective action was taken to reinforce the requirement for performing and documenting daily inspections, additional ongoing emphasis is needed to assure that the frequent inspections of hoists and cranes are performed.

**Observation 4.4.a-O2:**

In a number of cases, cranes and hoist inspections were documented in log books rather than on inspection tags which are attached to the crane or hoist, as required by PUB-

3000. While this may be an acceptable practice, LBNL policy and actual practice need to be harmonized.

b. Forklift safety, inspections and maintenance

Jean Myers was also commissioned to review the maintenance and inspection records for forklifts.

LBNL has a contract with Hyster Sales Co. to inspect, maintain and repair forklifts. The inspection and maintenance records are in the Transportation office in the Facilities Department. The records were reviewed, and sample records were obtained for this assessment. (Exh. 7)

In general, forklift maintenance and repair records are in good order. However, daily operator inspections are generally not documented. While daily inspections are required by OSHA, there is no OSHA requirement for documenting daily inspections. While documentation is emphasized in the forklift training program, there is no such requirement in PUB-3000, and daily inspection records are generally not available. An immediate reminder of the inspection requirement and a copy of the inspection form used in the forklift training program were sent out to all forklift operators immediately upon discovery of this deficiency. (Exh. 13 & 14)

**Finding 4.4.b-F2:**

There is no evidence that daily operator inspections of forklifts are performed as required by 29CFR 1910.178(q)(7). While there is no OSHA requirement for documenting daily inspections, and no PUB-3000 requirement for documenting daily inspections, a documentation requirement is emphasized in the forklift training program. These daily inspection records were generally not available.

**Recommendation 4.4.b-R2:**

While immediate corrective action was taken to reinforce the requirement for performing and documenting daily inspections, additional ongoing emphasis is needed to assure that the frequent inspections of forklifts are performed.

**Observation 4.4.b-O3:**

While LBNL has latitude in the implementation of OSHA forklift safety requirements, daily inspections are a requirement that deserves to be specifically enumerated in Laboratory Policy; e.g., PUB-3000.

## 4.5 Operator Training & Certification

a. Crane & Hoist & Forklift Operator Training

The crane, hoist and forklift survey conducted by Jean Myers also looked into the training and qualifications of crane and hoist operators. (Exh. 15) The methodology was to visit representative areas on site with cranes, hoists and forklifts and to ask area supervisory personnel who might be operating the equipment. These lists of personnel were then compared to the training database to determine who had the appropriate training and certification. A notice was sent to all Division EH&S Coordinators advising them of who was authorized to operate what equipment, and requesting that unauthorized personnel not be allowed to operate cranes, hoists and forklifts until properly trained and certified. (Exh. 13)

**Finding 4.5.a-F3:**

A number of individuals were identified as crane, hoist and forklift operators who either lacked the training or certification entirely, or whose training or certification had expired. Training is required by 29CFR 1910.178(l)(3) for forklifts, and it is implicit in 29CFR 1910.179(b)(8) for overhead and gantry cranes, and it is required by PUB-3000, Chapter 5.4 for all crane, hoist, and forklift operators.

**Recommendation 4.5.a-R3:**

While immediate corrective action was taken to reinforce the requirement for crane, hoist and forklift operator training and certification, additional ongoing emphasis is needed to assure that personnel are properly trained and authorized.

**Observation 4.5.a-O4:**

LBNL identifies personnel requiring training through the JHQ system. Some of the questions were confusing, leading personnel to answer incorrectly and resulting in failure to identify training requirements. (The JHQ questions have since been changed to eliminate this problem.)

**Observation 4.5.a-O5:**

The OSHA Inspection of 2004 identified the need to make the forklift training more equipment specific, and it also identified the need to provide training for personnel operating electric walk-behind pallet movers and lifters. Correction of this deficiency is under way but has not yet been implemented. (Exh. 16)

b. Crane & Hoist Instructor Qualifications

Qualifications of the personnel identified as crane, hoist and forklift instructors were reviewed. The crane and hoist instructors all had completed the North American Crane

Bureau training programs for crane instructors in the last two years. Copies of certificates are being collected in the EH&S Training Office.

**Summary:**

LBNL Crane Training Instructors are well qualified.

c. Crane & Hoist Operator Training Course Content

Jean Myers reviewed the contents of the hoist and crane training materials against the requirements in OSHA, PUB-3000 Section 5.4, and DOE Standard 1090 (Hoisting & Rigging). For details see Exh. 17 and 18. Jean Myers also audited the course EHS-210 on September 14, and Matt Kotowski audited the course EHS-206 on September 23.

**Observation 4.5.c-O6:**

The training materials and hand-outs used are technically correct, but are dated and are identified in part as draft documents. They should be updated.

d. Forklift Operator Training

Jean Myers reviewed the contents of the forklift training materials against the requirements in OSHA, PUB-3000 Section 5.4, and Chapter 10 of DOE Standard 1090 (Hoisting & Rigging). For details see Exh. 19. In addition, Matt Kotowski audited a Forklift Training class on September 6, 2005, and the Crane Operator Training Class on September 23, 2005.

**Summary:**

The forklift training covers most of the material in accordance with the OSHA requirements. Once the previously identified deficiencies are addressed (see Observation 4.5.a-O5) the course material will be satisfactory.

e. Forklift Instructor Qualifications

LBNL forklift instructors have had training in the past and have many years of experience as forklift instructors. Instructor qualifications were reviewed by the OSHA Inspectors in 2004, and records are on file in the EH&S Training Office.

**Summary:**

Forklift instructor qualifications are satisfactory.

## 4.6 High Value/High Consequence Lifts & Critical Lifts

LBNL addresses critical lifts on site under the heading of High Value / High Consequence Lifts.

Aaron Zude conducted a comparison of the Critical Lift requirements in DOE-STD-1090-2004 against the High Value High Consequence Lift requirements in Section 5.4 of PUB-3000. (Exh. 20) In addition, Jean Myers reviewed the records in the files of the Rigging Crew and verified that all requirements have been met.

**Noteworthy Practice:**

LBNL's High Value/High Consequence Lift Program incorporates all best practice elements of the DOE Hoisting & Rigging Manual, and there is evidence of excellent execution in the field.

## 4.7 Non-LBNL Cranes

On occasion, non-LBNL cranes are brought on site for specific projects.

a. LBNL Work

When cranes are needed that exceed the capabilities of the in-house cranes at LBNL, the Rigging Supervisor will contract with an outside vendor to bring cranes on site. On such occasions, the Rigging Supervisor verifies that the crane and operator certifications are current, and he also inspects the crane and the rigging.

b. Tree Work

Because of the wooded hillside environment and the attendant fire hazard, LBNL routinely contracts with tree trimming vendors to trim and remove trees. On occasion, the Rigging Supervisor has inspected the cranes used for this purpose, but there is no general requirement to do so.

LBNL has worked closely with the vendors in the last two years to agree on standards for hoisting personnel into trees. On that occasion, the vendors demonstrated that they comply with all requirements of the corresponding ANSI and Cal-OSHA standards which regulate how personnel are lifted into trees.

c. Construction

The third route for cranes to come on site is when a construction contractor brings a crane to a job site. When that occurs, the LBNL Construction Safety Engineer reviews the certifications for the crane and operator. In the past, the Rigging Supervisor inspected construction cranes and rigging before they were allowed to operate on site.

**Observation 4.7.c-O7:**

Tree Trimming and Construction Contractor cranes and rigging equipment are not inspected and thus are held to a lesser standard than other cranes on site. Consideration should be given to reinstating the inspection of tree trimming and construction contractor cranes by the LBNL Rigging Supervisor.

## 4.8 Best Practices in DOE-STD-1090-2004

Aaron Zude and Jean Myers were also commissioned to evaluate LBNL practices by comparing them to the best practices in the DOE Hoisting and Rigging Manual. The results were recorded on a matrix table, which demonstrates that LBNL has adopted all relevant best practices contained in the standard, or else has adopted equivalent best practices. (Exh. 21)

**Noteworthy Practice:**

LBNL has largely implemented best practices identified in DOE-STD-1090-2004 Hoisting & Rigging.

## 4.9 Medical Qualifications for Crane and Forklift Operators

The medical surveillance program for forklift operators, crane operators, and riggers was reviewed by Matt Kotowski. Protocols for each of these categories exist in the Occupational Health Manager (OHM) system, and they are reviewed and affirmed annually. Each of the three protocols includes the following:

Consent Form
Employee Report of Exposure
Health History Review
Vision Test
Depth Vision Test
Peripheral Vision Test
Hearing Test
Blood Pressure
EKG, As Indicated

(Exh. 22)

**Observation 4.9 – O8:**

The medical qualification protocols exceed the requirements in the OSHA, ASME and ANSI standards, but the documentation in the OHM system does not reflect the results criteria in the ANSI and ASME standards. Consideration should be given to supplementing the medical protocols to mirror the requirements in these standards.

## 5.0 EXHIBITS

The following exhibits are available for inspection in the Occupational Safety Group Offices.

Exhibit 1 Lessons Learned: Hoisting and Rigging Incidents in the Office of Science
Exhibit 2 LBNL Work Smart Standards
Exhibit 3 PUB-3000 Section 5.4 Review to Standards
Exhibit 4 PUB-3000 Section 5.4 Materials Handling & Storage
Exhibit 5 Sample checklists & load test documentation
Exhibit 6 CR-51-008 crane procurement documentation
Exhibit 7 Sample forklift service reports and invoices
Exhibit 8 Response to Milt Johnson's Memo on Hoisting & Rigging Lessons Learned
Exhibit 9 DOE H&R Lessons Learned Matrix
Exhibit 10 Hoisting & Rigging DOE Lessons Learned PPT
Exhibit 11 Crane & Below Hook Lifting Devices Inspection Report
Exhibit 12 Crane & Forklift Field Survey
Exhibit 13 Operating Requirements for Cranes, Hoists & Forklifts
Exhibit 14 Daily Forklift Inspection Memo
Exhibit 15 Crane, Hoist & Forklift Field Training Assessment
Exhibit 16 Upgrade of Forklift Training
Exhibit 17 EHS-206 Crane Operator Training – Evaluation & Course Material
Exhibit 18 EHS-210 Hoist Operator Training – Evaluation & Course Material
Exhibit 19 EHS-225 Forklift Training – Evaluation & Course Material
Exhibit 20 High Value/ High Consequence Lift Analysis
Exhibit 21 Best Practices Analysis
Exhibit 22 Medical Protocols